SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

No. 1237.—Vol. XXIX.] LONDON, SATURDAY, MAY 7, 1859. [WITH JOURNAL] STAMPED.... SIXPENCE. UNSTAMPED. FIVEPENCE.

The Steam-Coal Question.

e following is a Summary of the Discussion on the Relative Prac- Value of the Steam-Coal of the North of England and Wales, at an important meeting of the South Wales Institute of neers, for which we are indebted to the respected President, Mr. ezer Rogers, whose courtesy we have before had to acknowledge nilar favours. A notice of the general proceedings appeared in last s Journal.

e papers now discussed differed very little as to the general theory and f combustion, but each of the authors had taken the view of the sub- om their stand point, and naturally regarded that most which had nterested them. The discussion of subjects like this in detail from nt points of view is one of the objects of this Institute, and a most e method of leading to improvement and further discoveries.

Fryar, whose paper introduced the subject, had given interesting ation on the comparative value of fuels, and had more especially l attention to coal, and the difference in value, and the mode of tion of the several varieties of coal gradating from highly bitumi- anthracite. He had called attention to the statement that bitumi- l, containing a large proportion of oxygen, formed more vapour , and other compounds, than was formed in semi-anthracite coal. ar had also reminded them that the smoke issuing from the burn- bituminous coal is mostly steam, coloured by floating particles of carbon; and from this and other points we have heard stated and l he concludes "that the relative heating power of coal is inti- connected with the proportion which the combinations of carbon n the products of its combustion." He also refers to the preven- moke from bituminous coal by admitting air into the furnace, but, me time, shows the great difficulty in effecting this practically. ox directs our attention to the heat given out in the combination n with hydrogen, and of oxygen with carbonic oxide. He then discusses the effect of hygroscopic water in different coals, and s that in estimating the theoretic value of coal, the amount of heat e hygroscopic water is assumed to neutralise should be deducted e theoretic value of the coals.

lark, in his communication, describes the several methods of burn- under steam-boilers, and concludes that we must either admit air rface of the fire, or we must make our fires so thin, that free oxy- pass through in sufficient quantity to consume the carbonic oxide. these papers in some shape had brought before the Institute the of the comparative value of the North of England and Welsh al; and the discussion to-day also had shown that to ventilate this as to a great extent the aim of the writers.

heorem maintained by Mr. Fryar he has been able to establish— he heating power of coal is intimately connected with the propor- h the combinations of carbon sustain in the products of its com-

The remarks as to the consumption of bituminous coal we will hereafter. The next paper, so far as it comprises a review only of does not differ materially, but it takes up also new ground.

ated, that in estimating the theoretic value of coals, the amount of ch the hygroscopic water is assumed to neutralise should be de- om the theoretic value of the coals; the argument for this point tained by the result of any practical experiments, and must be present as hypothetical only. No doubt can exist that the value l is reduced in the same ratio as the weight of hygrometric water the effect of that water to waste heat further in combustion by g the calorific effect of the fuel is still an open question. An opi- ils amongst practical men, that some advantage is gained by using naces with long flues in a slightly moist state, and that ash-pits kept so wet that steam may be generated by radiated heat given he fire-bars, and then passed through the fire—these practical opi- supported by high scientific authorities. Many persons assert that nally gained by the use of water; this, however, cannot possibly may be, however, that the radiated heat which would be lost is producing steam from the ash-pit, and so adds a little to the e coal.

ew is well explained by Gmelin, in his *Handbook of Chemistry*, ge 88. He states that:—"We often meet with the erroneous that the heat which may be obtained by the combustion of char- reased by the addition of water. Those who make this asser- that when the oxygen entered into combination with the hydro- n water, a certain quantity of heat was developed, which must d now that the water is decomposed by the carbon. The quan- t evolved is the same, whether carbonic acid is formed from nation of carbon and oxygen, or carbonic acid and water from ygen, and water; excepting that, in the latter case, an additional heat is rendered latent in the formation of vapour of water. The water lessens the *glow-fire*, but produces a greater quantity of onsequence of the formation of carbonic oxide and hydrogen has been also maintained, the coke, or carbon only, in all bi- oal, is the representative of its practical value; that in practice en is of no service, as its heat is so diffused as to produce no fect. This is a very important subject, and deserving of further Some time since Mr. Joseph Parkes made some able and accu- ments on this subject; as also Mr. Apsley Pellatt (for details papers in the *Transactions of Civil Engineers*, London, *circa.* e gentlemen found that for their purposes "one chaldron of ing 13 or 14 cwts., performed the same heating duty as 1 ton, of Newcastle small coal." In 1857, Mr. Apsley Pellatt again ttention of the Society of Arts to this subject (*Journal Society* vi., No. 263), and reiterated the same statement, and proved practical experiments on a large scale. In the discussion Mr. ellatt said—"In a question of this kind facts were better than n his manufactory for many years they used small coal in the lass, the consumption amounting to about 30 tons per week. the prejudices of himself and his workmen, he was induced The stokers asserted that it was impossible to get sufficient to do the work. However, the experiment was made, and a trial of eighteen months was that they practically got from oke the same amount of work as was obtained from 21 cwts. hat was a practical fact within his own experience."

known in practice that moisture in cokes creates flame, and s power to give intense heat in the glow-fire. All the h the coke has been found equivalent in effect to the total l from which it was produced seem to have been where in- at was required; and where there was no length of flues to render flame effective, and *vice versa* where bituminous and damp coal is found effective; for instance, in the Cornish boiler, where the flue is about 100 feet in length. From these data, and other experimental researches, we are led to the conclusion—That as we decompose or utilise coal, as at present, the carbon only is of effective value where intense local heat is required, as for glass melting-pots and furnaces with short flues and rapid draft where the flame cannot be used; also, that the effective value of a limited proportion of moisture in the coal seems to depend upon the length of the flues, and time allowed for combustion, enabling the heat of the flame to be used; in this latter case the heat taken up in the glow-fire is given out again in the flame.

We now come to the comparative value of the North of England and the Welsh steam-coal: this subject is of such immediate importance to the steam marine of this country and of the world as to demand a careful review. This Institute has, as a body, so far dealt with the subject, not as a party contest, but with a sincere desire to elicit the truth; let us always remember our national challenge—*Y gwir yn erbyn y Byd* (The truth against the world), and carefully avoid in these scientific investigations being led astray by our own prejudices or feelings. All the researches on this subject, the results of which are yet known, and may be useful to us, can be shortly classed in series thus* :—1. The "Reports on the Coals suited to the Steam Navy, by Sir Henry De La Beche and Dr. Lyon Playfair; presented to both Houses of Parliament by command of Her Majesty." London: W. Clowes; and Sons, 1848 to 1851.—2. The Newcastle-upon-Tyne Steam Collieries Association reports "On the Use of the Steam Coals of the Hartley District of Northumberland in Marine Boilers; by W. G. Armstrong, J. A. Longridge, and T. Richardson." Newcastle-upon-Tyne: A. Reid, 1858.—3. "Report on the Relative Theoretical Evaporative Power of Welsh and Newcastle Coals, with Tables showing the results of Experiments; by W. A. Miller, A. W. Hoffman, and E. Frankland." London: 1858.—4. "The Reports of Messrs. Miller and Taplin, on the Evaporative Power and Economic Value of Hartley Coal;" and a similar report, by the same gentlemen, "On the Properties of Welsh Steam-Coal," presented by the Board of Admiralty, 1859.—5. The actual experience of the principal ocean-going steamers, where economy in weight of fuel and great speed are absolutely necessary for their success and existence.

The first series of these reports was commenced in March, 1846, and completed about April, 1851. This enquiry was undertaken at the suggestion of the late Joseph Hume, M.P., whose keen penetration seems at this early period to have fully estimated its national importance. The reports by Sir H. de la Beche and Dr. Playfair commence by giving the principles and data on which they based their experiments. The results of their experiments as to the theoretical value of the coal they analysed have never been disputed. To know these truths is of great importance to the engineer; it gives him the knowledge of the point that separates the possible from the impossible, and he knows his bounds to work in. It is now his duty to show us how he can deal with a substance the true value of which he knows; but as its physical condition varies he must adopt right mechanical means to eliminate the power shown to be at his disposal. The formulæ by which the theoretic and true value of coals are calculated are not difficult to apply, and may be interesting and very useful to many; we will collect and explain them here—we take much of this from the able reports before us. The experimental data from which the results are deduced we will first explain.

Dulong has shown that one part by weight of carbon, burning with atmospheric air into carbonic acid, heats 13,268 parts of water 1 deg. Fahr., or one part of hydrogen 62,470 parts of water 1 deg. Fahr.†

Regnault has shown that the co-efficient for the latent heat of steam at 212 deg. is 965·7 deg.

Soule has shown that 1 lb. of water raised 1 deg. Fahr. exerts a force equal to raising 728 lbs. to the height of 1 foot.

These data are confirmed by many other philosophers working on the same subject; and simple as the results may appear, they have cost the noble men who established them years, and in some cases lives, of toil and research; we too often avail ourselves of the natural laws they have discovered without a due sense of gratitude.

Our calculation now becomes very easy. To determine the amount of water which 1 lb. of coke will evaporate at 212 deg., we have only to deduct the ashes and water it contains; the carbon (C) then left, multiplied by its heating power 13·268, and divided by 965·7, gives the number of pounds of water which the coke by itself could evaporate,

$$\frac{C \times 13{,}268}{965{\cdot}7} = x.$$

or, arithmetically expressed—suppose a quantity of coke dried at 212 deg. weighs 53 lbs., and contains 6 per cent. of ash and other impurities; we have then to deduct 3 lbs., leaving 50 lbs. of carbon; then $50 \times 13{,}268 \div 965{\cdot}7 = 686{\cdot}9$, being the number of pounds of water the coke could evaporate. The actual theoretic duty of a pound of coke or coal we may express by the number of pounds raised to the height of 1 foot, and this may be readily obtained by the simple formula—$W\,P \times 965{\cdot}7 \times 782 = x$. W representing water, of which P, pounds, are evaporated by a pound of coal. The theoretical value of coal, with reference to the number of pounds of water which 1 lb. of fuel will convert into steam, is obtained by the formula—

$$\left(\frac{C \times 13{,}268}{965{\cdot}7}\right) \times \left(\frac{H - h \times 62{,}470}{965{\cdot}7}\right) = x,$$

in which C is the quantity of carbon, H the quantity of hydrogen in a unit of fuel, and h the quantity of hydrogen corresponding to the oxygen contained in the coal. These multiplied by their heating powers, according to the results of Dulong, and divided by the latent heat of steam, indicate the number of pounds of water that can be converted into the latter by a pound of coal. The numbers thus obtained can be changed into the expression of mechanical force by the previous formulæ.

These data assume the water to be at a temperature of 212 deg., but as some heat is always taken up in heating the water from the temperature at which it is fed to the boiler, this must be calculated and added to the evaporative power before given: thus suppose the water to enter the boiler at 52 deg., then each pound of water will absorb 161 units of heat to raise it to 212 deg., or nearly 1 unit of heat for each degree of temperature, this must be calculated and added to the value of the fuel, as estimated by the foregoing data. Suppose the evaporative value of a coal, found by the forms before given, were equal to 10·75, then

$$\frac{10{\cdot}75 \times 161}{965{\cdot}7} = 1{\cdot}792$$

this added to 10·75 is 12·542, the true value of the coal.

The corrections for barometric pressure, the hygrometric state of the atmosphere, and the small amount of combustible matter in the clinkers or residue, are not necessary in ordinary practice. "The only omitted correction which in appearance might be supposed necessary for practical purposes is that for the hygroscopic water," and Messrs. De la Beche and Playfair state that "had they introduced corrections for these small quantities, practice would have been misled, because the coals will rarely reach a vessel in the dry state in which they did in the present case, when they were packed in hogsheads and kept under cover." The reports give, separately from the analysis, a table of the hygroscopic water found in many of the coals, but this will only apply to them under the circumstances described, and not as they come into the market for sale: this will vary almost daily with the weather, and to be of practical value the water must be ascertained when the coals are purchased. In the late analysis of Cardiff coals, by Messrs. Miller and others, to which we shall hereafter refer, this plan has again been followed, and they call special attention to it. The practical trials upon the evaporative power of coal described in these reports are the only points disputed.

The trials were made under a boiler giving exactly the same conditions as the form then used in the steam navy: the distinct instructions of the Admiralty being that the value of the coals for use in the steam navy should be ascertained, the reports give this; and in order that no one may be led to believe that these are the practical values of the coals under every condition and form of boiler, they made a series of experiments under a Cornish boiler, and obtained about 20 per cent. more duty from the coal in the latter (the Cornish boiler).

We now take the main points in the reports secondly referred to—the coals of the Hartley district, by Messrs. Armstrong and others; these reports were made for the Steam Collieries Association of Newcastle-upon-Tyne. The experiments seem to have commenced some time in 1855, and to be ended Jan., 1858. They commence the first report (Aug. 25, 1857) by stating that "the task of awarding the premium of 500*l.* which the Association offered in 1855 for the best method of preventing smoke during the combustion of the coal of their district (the Hartley district) in marine-engine boilers has been so great, that they are not in a position to report finally thereon." They give us no details of their experiments, or the data they used, except the "coal burned per square foot of fire-grate per hour; water evaporated from 60 deg. Fahr. per square foot of fire-grate per hour; total evaporation per hour from 60 deg. Fahr.; water evaporated from 212 deg. Fahr. by 1 lb. pound of coal." An apparatus was attached to the boiler by which the feed water was partially heated by the waste gases of the chimney. They assert "that the experiments were made with a boiler of the ordinary multitubular construction," and concluded by stating that "We are at present, however, able to state that under the most favourable conditions the Welsh coal does not exceed the Hartleys, either in the amount of work done in a given time, or in economy, and under the general circumstances of steam navigation falls short in both particulars."

The second part (Jan., 1858) states that "the boiler built for the experiments presents no peculiar features, and we annex a drawing to show it is only the ordinary type of a marine multitubular boiler, such as is generally considered to present the greatest difficulty as regards the prevention of smoke." The smoke-consuming plans sent in for burning West Hartley coal were 103 in number, and the way in which the fire-bars and surface were altered for the different plans is described. The result of all this is, that the plan proposed by Mr. C. Wye Williams, of Liverpool, is approved, and at page 18 we see it stated that "no particular attention is required from the stoker—in fact, in this respect the system leaves nothing to desire, and the actual labour is even less than the ordinary mode of firing. Mr. Williams's system is applicable to all descriptions of marine boilers, and its extreme simplicity is a great point in its favour: it fully complies with all the prescribed conditions." We notice at page 21 it is stated, the mode of firing is, as usual with bituminous coal, to charge on the dead plate, and push forward as required. Page 22 states that furnace management is an art; men must be properly instructed, and then kept to their duty, otherwise by bad construction and negligence the economic value of the fuel may be reduced one-third. The conclusion is again the same as at page 17, first part, and simply an affirmation that West Hartley coals are better than Welsh coals.

The third report (same date as last, Jan., 1858) describes a trial of one specimen of what is termed by them best Welsh coal, under the boiler before described; it does not give us the name of this coal, but states it contained 20 per cent. of small, and assumes that all "Welsh coals are liable to very great deterioration when kept in store." The Welsh coal evaporated 12·35 lbs of water, and the West Hartley 12·90 lbs., both from 212 deg., and in every other respect the latter was found far the best. The report concludes by stating that the absence of smoke was the cause of the extensive use of Welsh coal. "But beyond this is was the reports in question which first gave the Welsh coal its high character. It was the consequent extensive adoption of this coal by the steam navy and public companies which gave to this character the apparent sanction of practical experience. The figures of the report were implicitly believed in, although from the beginning there were many who doubted, but their opinions being attributed to interested motives could carry no weight against Government authority and Government practice, and so a grievous error eventuated in a grievous injury, both to your district and to the national interests."

The former part of the paragraph we will refer to hereafter.

The three reports are marked by personal allusions to Messrs. De la Beche and Playfair, and strong assertions that there was something wrong about their report, and they had done "grievous injury both to the West Hartley district and to the national interests;" but not a single scientific point or experiment to the purpose is raised or brought forward to prove this. This is quite contrary to the rules and present practice in scientific enquiry. We are next told the boiler is of the ordinary multitubular construction, and this is again afterwards repeated, as if to make some point; but on referring to the Government Report, by Messrs. Miller and Taplin (which we will hereafter notice more fully), we find they state (p. 18) "That the boiler at Newcastle was obviously made specially for experimental trials of a peculiar coal. Its proportions favour in a remarkable manner the combustion of bituminous coal. The two furnaces were large and roomy, and by presenting a wide and high front were well adapted, and apparently designed, expressly for the application of Mr. Williams's patent smoke preventer. Beyond the fire-bridge there was a large heat-chamber, where the unconsumed gases that might accidentally escape beyond the bridge were mixed and inflamed, so that, practically speaking, almost perfect combustion was obtained, with a higher temperature than is usual passing through the tubes. This was well illustrated by sight-holes made in several places behind the boiler, through which, during the many experiments that were made, the luminous appearance of the proceeds of combustion, as they passed over the bridge, might be clearly seen; but this enlargement of the boiler at that particular part involves consideration

* The reports of the French and American Governments are omitted, as not strictly of importance in this present enquiry.

† These, for convenience, are termed units of heat. The amount of heat necessary to elevate 2·204 lbs. of water (=1 kilogramme) from 0° Cent. to 1° is assumed as unity.

before such a description of boiler could be applied to steam-vessels in Her Majesty's Navy. Still I believe it to be undeniable that the large amount of success at Newcastle, resulting from the practical experiments on Newcastle coal, is greatly attributable to the spacious heat-chamber above referred to."

These statements are so totally different, and involve results so serious to the subject we are reviewing, that we must now be doubly careful to examine the evidence; one assertion or the other must be wrong. An inspection of the Newcastle boiler, the drawings of which are before you, will enable you to decide. "The plan of Mr. C. Wye Williams's system, as is well known, consists in the admission of air at the furnace door, or at the bridge, or at both, by numerous small apertures, with the intention of diffusing it in streams, or jets, amongst the gases." We must again bring facts and experience to bear upon this. About 1839, or some 20 years since, Mr. Williams obtained a patent for this very plan of economising fuel: all that is now stated in the reports before us, and much more, was then hoped from it. Almost every member present has read Mr. Williams's "Treatise on the Combustion of Coal," or his prize essay from the Society of Arts on the "Prevention of the Smoke Nuisance." Few persons dispute Mr. Williams's theory; it is based on laws at present generally admitted as proven, but the practice and working results have yet it seems to be dealt with, and this is the main subject before us. To ensure the utility of this plan, the valves, or openings, to admit air to the fuel must be very carefully adjusted from time to time; the outlet of the chimney stack must be watched closely, as also the fire in the furnace. If too small a supply of air is given soon after firing the smoke is not prevented; if this supply be allowed to continue the same the fuel is wasted; and when several fires, as in all large steamers, run to one chimney, or stack, then it is most difficult to ascertain the state of the fires requiring air or otherwise, and when the smoke is prevented a large proportion of fuel is often burning to waste, almost without possibility of detecting it; and at sea, in rough weather, the stokers, if they were capable, are too busy to attend to the valves, and they shut them up altogether. It is strong evidence of the impracticability of the plan that in the great port of Liverpool, after 20 years' experience, and where the inventor has much influence, the use of the plan, with very trifling exception, is confined to a few steamers plying in the Irish Channel, and scarcely known in practice, or to any extent, by the ocean-going steamers. In fine weather, if the coal smokes, the stokers leave the door of the furnace slightly open for a short time after firing, and use this plan instead of the valves referred to.

The experiments on Welsh coal were confined to one sample; we are not informed from what district or place in South Wales, and the assertion that, as a class, all Welsh coal is liable to great deterioration when kept in store, is so contrary to the experience of the West India Royal Mail Company and other firms, as to compel us to class this with the former conclusions arrived at in these reports. We cannot but feel pained to see in these reports an attack on the character and reputation of two gentlemen who, from their zealous and true work done to science and human progress, deservedly rank with the leading men of the age. After many preliminary personal allusions, they close the impeachment by asserting "Messrs. De la Beche and Playfair to have committed in their reports to the Government a *grievous* error, eventuating in a *grievous* injury, both to the West Hartley district and to the national interests." We must bear in mind that these serious charges are made without the slightest attempt to prove them in any way by the laws of evidence, and such attempt, as we shall hereafter show, would, if tried, be futile.

The facts as to these reports are, that during the five years they occupied pecuniary grants were made at different times by the Government for their prosecution, to the amount altogether of 2639*l.*, for machinery, apparatus, and all the labour and work; thus sum was far too small for the effectual prosecution of the enquiry. The reports of the French and American Governments had been made on the same subject, and the scientific reputation of our country was to some extent involved in our doing our part truly and well. The patriotism of our men of science now came to the rescue: Sir H. de la Beche and Dr. Playfair resolved to forego any pecuniary compensation; their five years' work was given freely to their country, and their noble example induced their excellent assistants to accept a mere pittance as salary, to enable the work to be carried out. These gentlemen were not associated with trade, they had no interest in any way, but the search for "Truth," and time and experience confirm the positive accuracy of the results they then arrived at. These grievous personal accusations in the West Hartley Reports appear to me so unfounded, that without further remark I may leave them to recoil upon their authors.

The report of Messrs. Hoffman and others to the South Wales Coal-owners' Association now follows. This seems to be simply a confirmation of De la Beche and Playfair's report. No coals are reported upon here but those from the Aberdare Valley only. The best of the South Wales coals (according to the Government experiments)—the Ebbw Vale, is not referred to in either the West Hartley or this report; this coal was far better for trial with the West Hartley than the semi-anthracite of Aberdare, as it can be adapted to any usual form of boiler. It would have prevented some confusion if a more definite title were used by this Association, as the reports are confined to Aberdare coal, and South Wales coals generally are not in any way represented or examined; and the Association at present has only a local character, and represents only a portion of the district, or the coalowners of South Wales. All we have as to the practical details of any experiments we find in the reports by Messrs. Miller, Taplin, and Lynn.

The fourth series of reports, by Messrs. Miller, Taplin, and Lynn, states that they are directed by the Admiralty to report upon the experiments of the North of England and the South Wales Collieries Association; they explain in part how the experiments are conducted by both parties, and regret the difficult position they are placed in "from the spirit of rivalry actuating the parties concerned," and plainly intimate that neither of them are really searching for truth. They report "that it is possible to consume the smoke arising from North Country coal by the use of Mr. Williams's apparatus," but they give no opinion as to its practicability in regular work at sea. They state that "when the smoke from the North Country coal is consumed its evaporative value is nearly equal to that of Welsh coal, but these comparisons are only made upon the supposition that the smoke from the North Country coal may be reduced to the same minimum as that which may arise from Welsh coal. Mr. Taplin was afterwards (Jan. 27, 1859) directed to report fully on the merits and value of the South Wales and North Country coals." After showing in the Appendix to these reports the difficulties in making any satisfactory report on the subject under present circumstances, he declines giving any opinion.

The fifth, and last, evidence we have to examine is the actual experience of the principal ocean-going steamers, where economy in weight of fuel is absolutely necessary for their success and existence. The assertion in the West Hartley Reports that the Admiralty Reports "first gave the Welsh coal its high character" is incorrect. The free-burning coal of South Wales was the earliest used for ocean steam navigation. About 1837 a series of experiments was made at Bristol with different coals, the object of which was to determine the coal to be used by the *Great Western* in her first voyage to America; the superior character of the coal was fully proved by experience, and was one great source of her success. Ocean steamers were soon multiplied, and Cunard's line, the West India Royal Mail Company, the Peninsular and Oriental Company, and others, were established, all these using Welsh Coal. At the time the Government Reports were published, an opinion prevailed that none other but Welsh coal could be used for long voyages; these opinions are now somewhat modified, but yet we have the practical fact before us, that after these many years' experience and trials, on a large scale, of the different coals, found not only in Great Britain, but other parts of the globe, nearly all the ocean-going steamers of every nation still used the Welsh coal. The ocean-going steamers from Liverpool are the Cunard and the Collins lines, both celebrated, and perhaps for the speed and regularity of their work are not equalled.

The country around Liverpool abounds with coal cheaply worked, yet we find these steamers entirely supplied with Welsh coal, conveyed by railway about 150 miles, or subject to an equally expensive transit by sea. The port of Southampton, the home station for the West India Royal Mail Company, the Peninsular and Oriental Company, and others. Welsh steam-coal is exclusively used by some, and mostly by all these companies. The small proportion of North Country coals consumed is, not as the Welsh, supplied generally under contracts, but taken as a last resource in case of short supplies from Wales. Numerous other cases like these may be quoted, but are not necessary here.

The great steam navigation companies are the jury empanelled to try this issue from time to time (for as ne improvements are made in machinery new conditions arise as to the economic use of the fuel), this jury are, under the heaviest penalties, bound themselves to try the question fairly, and give a truthful verdict, and from their verdict commercially we have no appeal.

The conclusions I arrive at from the mass of evidence examined and submitted to your consideration are:—

1. *That the Reports of the West Hartley and South Wales Associations give no new scientific data; and the practical experiments (as proved by Messrs. Miller, Taplin, and Lynn, in their reports to the Admiralty, and the facts now laid before you) are of little value as evidence, and calculated to mislead.*

2. *That the Reports made to the Admiralty by Sir H. De la Beche and Dr. Lyon Playfair are the only reliable scientific work we have on the subject; and at present the results of their practical or economic experiments are not much altered by mechanical improvements in utilising the fuel; and this is completely proven by the fact, that the great steam companies referred to do not use largely any other than the South Wales steam-coals; and that these companies, using and experimenting at sea upon nearly one million of tons of coal annually, are far better able to form an opinion of the true practical value of the coal than can be done by single experimental boilers on land.*

3. *That any attempt for the owners or vendors of coal, or any mercantile commodity, to settle the relative quality for the consumer or vendee is wrong in principle, is in itself absurd, and must be futile. The consumer will always try to buy the best article for his purpose in the cheapest market. The superior theoretic value of the South Wales steam-coal is an established truth, and not disputed. The fact that, after long experience, the great ocean steam companies now buy and use almost exclusively South Wales coals is unanswerable evidence of its practical superiority.*

THE COAL OF SOUTH WALES.

The very elaborate paper on the Coal Field and the Coal of South Wales, read by Mr. Joshua Richardson, M.Inst.C.E., at the Institution of Civil Engineers, has just been reprinted from the *Transactions*, and an appendix and notes added, which will doubtless prove acceptable to all interested in colliery operations. A comparison of the ideas entertained now and ten years since will not be uninteresting. Mr. Robert Stephenson then stated what after all the experiments, Government and otherwise, has turned out to be about the fact, "that the discrepancies amongst experimentalists had principally arisen from the fact of coal not being a simple substance, and the various qualities requiring to be consumed under different circumstances, in order to derive from its combustion the greatest amount of useful effect. In the Cornish engines, where anthracite, or the semi-anthracitous, coals were almost universally used, every means was adopted to insure slow combustion; the consequence was that more duty was obtained than from any other engines. This must arise from the circumstance of the combustion being more perfect, one atom of oxygen combining with one atom of carbon, and no more; for if one atom of oxygen carried off two atoms of carbon, the consumption of fuel would become excessive and wasteful." This is the whole secret of the superiority of North Country coal over Welsh, and *vice versa;* if the furnaces be properly constructed and well attended, both coals will give good results, and each will be preferable for its peculiar purpose. The appendix proves the gratifying fact that 92½ per cent. of the coal produced in the United Kingdom is consumed at home, and that only 7½ per cent. is exported to foreign countries. The subjoined table will show how this result is arrived at:—

Table of the Coal produced in Great Britain and Ireland during 1855:

Districts.	No. of Coal Mines.	Coal produced by each Mine.	Exported to Foreign Countries.	Used for Home Consumption.	Total tons of Coal produced.
Northumberland and Durham	273	56,452	3,014,372	12,417,028	15,431,400
Cumberland	23	35,250	2,441	808,108	810,549
Yorkshire	333	23,265	78,451	7,669,019	7,747,470
Derbyshire and Nottinghamshire..	191	16,049	—	3,065,400	3,065,400
Leicestershire.....	11	38,635	—	425,000	425,000
Staffordshire and Worcestershire..	500	14,646	—	7,323,000	7,323,000
Lancashire.....	357	25,070	426,139	8,523,861	8,950,000
Shropshire.....	56	19,383	—	1,105,250	1,105,250
Gloucestershire, Somersetshire, and Devonshire.....	88	16,257	7,149	1,423,471	1,430,620
England	1832	25,321	3,528,552	42,760,137	46,288,689
South Wales	245	34,907	1,120,947	7,431,323	8,552,270
North Wales	65	17,307	—	1,125,000	1,125,000
Scotland.....	403	18,171	246,988	7,078,012	7,325,000
Ireland	19	7,611	—	144,620	144,620
Totals.....	2564	24,741	4,896,487	58,539,092	63,435,579

The lapse of time since the publication of the paper has not lessened its value, and the above table will enable an idea to be formed of the comparative amount of capital employed in each district.

EAST INDIAN IRON.

An important meeting was held in the Council Hall, Sheffield, on Saturday last, for the discussion of various matters connected with the trade and prosperity of the town. The meeting had been convened by members of the Chamber of Commerce, and was attended by a number of gentlemen intimately associated with the manufacturing interests of the district. Facilities for the development of Indian commerce being one of the subjects taken into consideration, as a natural consequence, the iron of India was was brought under especial notice.

Mr. George Hadfield, one of the recently elected members, having expressed a desire for further information respecting this valuable product, Mr. John Brown, of the Atlas Works, intimated his readiness to explain to the meeting his views with reference to what he individually considered a very important item—iron as produced in India. For some time past Indian iron had been in bad repute, not that he believed there was any cause as far as *quality* was concerned, but because there had been a strong prejudice against any iron, particularly connected with Sheffield steel purposes, being manufactured from any kind or description of *pig-iron* whatever. He was delighted to know that the time had now arrived when that prejudice would be removed. To a certain extent it had been removed already, and he thought by diligence and perseverance they would overcome all the difficulties with reference to the production of iron for steel purposes; and he believed that Indian Iron would produce the best material for Sheffield use. Some time ago he was requested by an eminent engineer in London to give his attention to Indian pig-iron for the manufacture of railway springs; this gentleman was deeply interested in Indian matters, stood very high in London, and manifested great interest with reference to Indian Iron: some experiments had been made by him in connection with a house in Staffordshire, which failed and disheartened him. He (Mr. Brown) gave his attention to the matter, he found difficulties to overcome at the commencement, but by one experiment after another, he was happy to say, he had succeeded in demonstrating that iron as produced for file purposes from Indian pig was superior to any other iron produced in this country; and he might go further, and say that it was proved to be superior to ordinary marks of Swedish iron for steel purposes. The price had been very much against the introduction of the iron, but he was glad to say the East Indian Iron Company would now sell it at a price which would pay them, and enable the manufacturers of Sheffield to use it in large quantities: he had heard from a gentleman only yesterday, who had made a purchase of something over 1000 tons of Indian pigs for the purpose of making them into railway tyres. At the present price, 6*l.* 10s. in London, they would use Indian iron in very large quantities. The iron was adapted for various purposes, such as the making of railway springs, which in itself was a large item, and the quantity consumed in it would be very considerable; but it was peculiarly adapted for many other purposes in connection with the steel trade of Sheffield. At his own establishment there had been some very severe tests with reference to the sustaining and lasting properties of Indian iron. One of the inspectors of a large railway had submitted some springs to severe tests, his object being, if possible, to find the breaking point, but he gave the matter up in despair, and was not able to break the springs, though he tested them as near straight as possible. The Indian iron was less in price than Swedish iron, and there could be no doubt that ultimately it would be very extensively used in this county.

The Chairman, Mr. C. Atkinson, Mayor of Sheffield, further informed the meeting that he had the opportunity of making the first steel in the town from Indian iron. "From that time," he added, "Indian iron has slowly, but surely, been making its way: that it will go on, and that India will ultimately become one of the largest sources from which we shall draw our raw material, I feel perfectly convinced."

Glances at Recent Geological Literature.

COSMOGONY; OR, THE RECORDS OF THE CREATION, BY "F.G.S."

It is a well-known fact, and long established by astronomers, that the apparent intersection of the terrestrial equator by the ecliptic (called the equinox) never occurs at the same point, but that every year this point recedes by about 50″·18. This apparent retrograde motion is termed the "procession of the equinoxes," the cause of which has long been a *vexata quæstio* amongst astronomers and mathematicians. Sir I. Newton gave up the problem for the want of sufficient data. The delicacy of the phenomenon of this change will be appreciated, from the fact that it can only be detected by very careful observations carried on during long series of years, the amount of the change being only 42 minutes in latitude in fifty years. Astronomers have informed us that the slow change produces results of immense importance in comparatively few centuries. "Since the formation of the earliest catalogue on record the place of the equinox has retrograded about 30°."—(See Herschall's "Astronomy.") "The Polar stars in the course of a long period of time will be in the zenith of London; or, in other words, England will be under the Polar stars, which is precisely the same thing." It appears that the zero point of Hipparchus, then in Aries, has moved from the south-east towards the north-west 30° in longitude, and 11° in latitude within 2000 years. This well-known change has been hitherto attributed to an axial oscillation of our globe, but, according to the author of "Cosmogony," proceeds from a spiral motion in the crust of the earth round the axis, from the south-east towards the north-west.

The object of the author of "Cosmogony" is to draw attention to this well-known movement, and to show that if we properly apply it to the observed changes going on over the entire surface of the earth, we should have no difficulty in accounting for all the discoveries made by geologists, and reconcile the same with the records of Holy Writ. Here, then, we have a key in the well-known phenomenon of change to unlock the mysteries enclosed in our rocks, instead of dubious hypotheses, which only tend to darken the gloom thrown over the past. We live in a critical age; we call continually for verification, application, and observation, as the counter checks to mere theories. We find by experience that it is far safer and wiser to trust to the combined results of various independent investigations, reduced to a system, than to depend on any theory based on mere assumption. Before proceeding further, we shall refer to the origin of the present theory of the "procession of the equinox."

In 1747, Bradley came to the conclusion that the phenomenon was produced by a swinging conical motion of the axis of the globe, although neither Bradley nor any subsequent astronomer have ever detected any change in the angular position of the earth's axis; consequently the assumption was not in accordance to observations, but merely suggested as a possible cause at that time, and no more.

D'Alembert attempted to solve the problem in 1749, and published another solution of the phenomenon. M. Poinset, a distinguished member of the Institute of Paris, has recently shown, in a very able paper, that the complicated speculations of Bradley and D'Alembert are totally untenable, and that the "procession" would be the same whether the globe were solid or hollow; hence it will be observed that the present theory is extremely unsatisfactory, even according to our modern mathematicians: yet this phenomenon of the procession proves that there is a constant movement towards the Polar stars. Geological discoveries have proved, also, that the earth's *surface* has been, and that it still is, subject to constant mutations; therefore we are better prepared to accept a theory founded on a *superficial* movement which is known to exist, than one founded on an *axial* movement which has not been established. The author of "Cosmogony" brings forward various historical and geological facts to show that the phenomenon of the "procession" is produced by an oblique movement of the surface of the earth, and thus accounts why tropical remains have been brought from the south to the northern hemisphere. If, then, this spiral movement of the surface of the earth can be fairly established, it will reconcile geological researches with the records of Holy Writ, in a far more satisfactory manner than has ever been attempted heretofore.

Should the result be as represented in "Cosmogony," the following changes must have taken place during the last 6000 years. "Let us take, as an example, the spot on which Greenwich Observatory now stands—say, latitude 51° 28′ 38″, and compute its position at the time of Flamstead, 150 years ago, when it was first established. It was then in latitude 50° 39′ 8″; and with reference to the equinox, 2° 5′ 15″ further east. Where was it 2000 years ago? According to the same computation, which is founded on an incontrovertible astronomical data—the rate of "procession") it was in lat. 40° 28′ 38.″ Where was it 4000 years ago? It was in lat. 18° 28′ 38″. Hence the phenomenon of the "procession"—the observed north-westerly movement of 50″·18 per annum appears to be the *vera causa* of geological changes which have so long puzzled our philosophers. Admitting, then, that the "procession" proceeds from the spiral action of terrestrial electro-dynamics, and that this causes a change of 12° northward in 2000 years, we can easily account for the existence of sedimentary deposits of the tropics in the northern hemisphere.

"Turtles, ammonites, corals, saurians, &c., as are found in Portland and other places on the south coast of England, are most decidedly the productions of a hot country; therefore it is absolutely necessary to suppose that parts of England once lay under the sea within the torrid zone."—"Indeed, all geologists when they attempt to restore the relics of the organic remains, and place them in their scene of life as they once flourished, are compelled to refer to the present conditions of the tropical regions."—"What can be more conclusive than this to show that the lands of northern regions have been in the torrid zone?"

According to "Cosmogony," England was within the tropics 5000 years ago, and "the wealden inhabited by monsters of the reptile tribe—crocodiles, rhinoceri, turtles, sharks sporting and watching for their prey. The banks of the rivers and lagoons covered with forests of palms and fern trees of gigantic magnitude," but which in the course of ages have become entombed in the soil, mud, and sand, forming new lands for different productions in more northerly latitudes. This places the phenomenon of the "procession" in quite a new light, and presenting us with enlarged views of the harmony and sublimity manifested in the great works of the creation; also opening out a large field of labour that promises a brilliant harvest to the persevering geologist and the investigator of terrestrial electro-dynamics. Those who have had their faith in the Sacred Record shaken by the "Vestiges of Creation" should read this small work, as it will afford them much strength in support of the established creed, which cannot be subverted by any geological discoveries.

ARITHMETIC FOR PRACTICAL MINERS.—Although an expert arithmetician would have little difficulty in performing all the calculations incident to mining, it cannot be denied that a "Miners' Manual of Arithmetic" is a desideratum—the adoption of special rules for rendering problems, which would otherwise be complicated, simple being highly advantageous. Mr. Wm. Rickard, who so ably filled the post of Teacher of Practical Mining in the Truro Mining School during the whole period of its existence, has just issued, through Mrs. Heard and Son, of Truro, a work in every way calculated to prove useful to the mine agent and the schoolmaster in mining districts. It includes all the calculations employed in metalliferous mining districts, several of which are but generally known; amongst them are the principles upon which Mr. John Hitchitts have arrived at their tables for calculating the rise or fall in the copper sta... method of approximating to the value of the ore in a vein, &c.; the division of the ... ceeds of a parcel of ore among the men, &c.; and the examination of the methods ... estimating the value of tin ores, &c.; besides a complete course of mensuration. In the geometrical portion of the work he has, by an arrangement of the problems in practical geometry, facilitated the acquisition of that essential to the qualified mine surveyor, and in the treatise on plane trigonometry the same course is carried out, the simple problems being first explained in the order in which they appear most naturally to succeed each other; thus the examples are all worked by natural numbers, until it can be clearly shown that the introduction of logarithms will greatly facilitate the calculations. In the treatise on mine surveying the student is led from the useful old method of dialling or surveying with the needle only, to the method of keeping the dialling-book, and forming the plan with the protractor and scale; the use of the complete theodolite, and the method of forming the plan without the protractor, which is adopted by some of the most accomplished surveyors. The method of using the plain theodolite is fully explained, and also of simply entering the survey into the dialling-book, and of reducing the angles to angles from the north point of the meridian. The application of trigonometry to mine surveying, explained in the treatise on plane trigonometry, is further exemplified, and a very important method of keeping a record of the survey and forming the plan without a protractor is given. It frequently happens that a survey must be commenced at the engine-shaft, and that, consequently, the theodolite is the best instrument for commencing such survey; but from the want of a method for reducing angles so taken to angles from the north point of the meridian, this has hitherto been consider...

a difficult operation. The simple method, however, which Mr. Rickard has explained will render this operation as easy of accomplishment as if the needle had been employed previously in the same survey. The methods of finding the variation of the needle, which is very important to the mine agent, and this, though not new, he has simplified as much as possible. The short course of levelling and land surveying, with which the work concludes, is considered sufficiently extended for the use of mining agents, the latter assisting them to fill in the details of their surface plans with the chain only, after all the principal parts are carefully laid down. The work has been eulogised by Capt. Chas. Thomas and the other agents at Dolcoath, Capt. Nichs. Vivian, Capt. Jos. Vivian, Capt. Jas. Pope, and other leading mine captains and surveyors of Cornwall; and the treatise only requires to be known to become a favourite with practical miners generally.

ON THE METALLURGY OF LEAD.

We last week published the elaborate and instructive paper of Mr. John Arthur Phillips, detailing the various processes for the Treatment of Lead Ores, as read at the Society of Arts, and now give the discussion which followed:—

Mr. ROBT. HUNT, F.R.S. (the Chairman), said, if he understood rightly the objects of the Society of Arts, he thought that such papers as the one brought before them that evening fully carried out its intention. Mr. Phillips had detailed to them the processes which were employed in the smelting of lead ores up to the last improvements which had been introduced. Still it would be admitted by him, and he was sure it would be admitted by others familiar with the subject, that there remained great improvements to be made, for they were still suffering an enormous loss from the imperfections of even the best known processes. They might, therefore, hope that some gentlemen would be induced to offer some remarks upon these points, and the result might be the quickening of some dormant thought, and thus lead to improvements in this branch of manufacture. He thought it would not be out of place to refer to one individual to whom they were specially indebted for much progress in this department of metallurgy. Mr. Phillips had referred to the process invented by Mr. Hugh Lee Pattinson for extracting the silver from lead ores. Within the last year that gentleman had been taken from them; and he thought this was a legitimate opportunity for acknowledging the debt of gratitude that they owed him. He was in every respect a remarkable man. When a poor boy, in a small druggist's shop, in the little town of Alston, he taught himself chemistry, never having had an instructor. He was in every sense of the word a self-taught man; and he was a most industrious one, a most earnest worker, and a man of the closest and the keenest powers of observation. He was led amongst other things, by seeing the mode of lead smelting that was going on in his own immediate vicinity, to direct his attention to the means of separating the silver from the lead, and after making a series of experiments, he succeeded in producing a process which, for a long period of years, saved not less than 20,000 ounces of silver annually, which had previously been thrown away. Not only had this self-educated man effected this, but he had introduced another useful product from the lead ores, the oxy-chloride of lead, and had also given us a process for the preparation of the carbonate of magnesia from the dolomite, or magnesian limestone of the North of England. There was, however, nothing more remarkable in the career of this distinguished man than the way in which he bestowed the fortune which his industry secured to him, in promoting the best interests of those around him. In the neighbourhood of the works, now carried on by his family, he established schools, in which hundreds of workmen and children were educated. His was, therefore, a name, in connection with this subject, which he could not allow to pass without the brief comments which he had ventured to make.

Mr. HYDE CLARKE, on being called upon by the Chairman, said he had not such a practical acquaintance with the various branches of metallurgy as Mr. Phillips possessed, and he had had very little to do with lead smelting. Mr. Phillips' observations, however, had tended very much to draw his attention to one subject which had been adverted to—the importance of considering the operations of smelting as a whole, when working for the improvement of any particular process. It certainly was a great misfortune that in metallurgical pursuits too many practical men were absorbed in their own particular branch without studying the other branches; whereas in reality there were very few processes which, if carefully examined, would not be found capable of affording some hint for the improvement of other departments of metallurgy. It was a subject to which he trusted Mr. Phillips himself would be induced to turn his attention, for the purpose of carrying out those practical objects which the Chairman had mentioned. There were few branches of metallurgy in which serious losses were not sustained by the employment of some old process, whereas in other departments of industry many important improvements had been introduced. The observation made by the Chairman with reference to the late Hugh Lee Pattinson had brought to his mind another subject—the neglect of so many important mineral products which still existed in this country, notwithstanding all the improvements made. With regard to the particular subject of silver in lead, he had in his own museum specimens collected 50, 60, or 80 years ago, of lead ore containing 40, 60, and 80 ounces of silver to the ton, which were left unwrought for years, because it was considered that they were not susceptible of economical application, whereas, by the improvements introduced, the production of silver in this country had become very considerable, a subject with which no one was better acquainted than the Chairman. Those improvements had been the means of realising a very great quantity of silver from ores the produce of this country, besides which, the improvements of Pattinson and others had enabled them to treat a large quantity of foreign ores brought to this country for that purpose. The great increase which had taken place in the production of silver in this country was an encouragement for the carrying out of similar improvements. They had recently had a paper read before the Society upon the utilisation of waste substances, and he would renew the remark which he made on that occasion—that in no branch of manufacture was there greater waste than in their metallurgic operations, and every process by which they could economise the substances now wasted was worthy of the highest consideration.

The Rev. DANIEL ACE said, having formerly had the charge of the parish of Alston, it was his privilege to come in contact with the late Mr. Hugh Lee Pattinson, and he could testify that a more humble and liberal-minded man he was never privileged to conserve with; for, notwithstanding his high attainments in science, he was ever ready to communicate his knowledge to others, and to do his utmost to promote the happiness of those with whom he was associated. In a religious point of view, he was desirous to promote that independence of thought, as well as liberty of action, which he (Mr. Ace), as a clergyman, conceived to be the glory of mankind.

Mr. WARRINGTON expressed the pleasure he had derived some years since, from a visit to the smelting-works at Alston Moor, at which time the flue which was suggested by Bishop Watson extended for a distance of three miles. He believed it was now considerable longer. From that place an enormous quantity of soot was annually taken, and he believed as much as 300 tons of lead was derived from that flue, which would have been driven off into the atmosphere as smoke, destroying vegetable and animal life.

Mr. J. A. PHILLIPS said the fumes caught in well-constructed flues generally amounted to 1 or 1½ per cent. of the lead contained in the ore put into the furnaces; but the amount of silver was very much smaller; and they found that the fumes from ores containing 20 ounces of silver to the ton would in very few instances contain more than 2 or 3 ounces of silver. He had analysed the fumes from different parts of the flue, and had found that in the first 100 yards the proportion of silver was greater than in the next 100 yards, until, as the chimney was approached there were scarcely any traces of silver. Instead of flues condensers of various kinds had been employed, which were found very efficacious for the condensation of the fumes, and when employed with the Castilian or other blast-furnaces they did not materially impair the draft, since the furnace was not dependent upon the natural draft, but upon a blast forced in by machinery. When, on the other hand, they made use of reverberatory furnaces, a condensing chamber materially checked the draft from the flue, and every practical lead smelter would bear him out that it was exceedingly difficult to obtain good results with a furnace having a bad draft. When speaking of the combination of silver and lead in the galenas, he remarked that it would appear in many cases that the sulphide of silver was combined mechanically with the sulphide of lead, whilst, in other cases, the two sulphides were in a state of chemical combination. Alluding to specimens upon the table, Mr. Phillips remarked that in the case of one of them the silver was almost entirely lost if the ore was treated by washing, whilst in the other the loss of silver, by similar treatment, did not amount to more than 2 ounces to the ton. In the first case the sulphide of silver was mechanically combined, and in the second it was in a state of chemical combination with the sulphide of lead. Mr. Hyde Clarke had stated that in the metallurgic operations of the present day there was still a great waste of useful products. No doubt such was the case. There was a great want of chemical knowledge in the mining districts of the country. An instance occurred a short time ago in which large quantities of oxide of iron, usually called gossan, were thrown away from a mine in Cornwall, it never having occurred to them to test it for silver; on its being examined, however, it was found to contain silver to the amount of 15*l.* per ton, and as it was obtainable in large quantities this discovery materially enhanced the value of the property. He had no doubt that not only silver but nickel and cobalt existed in much larger proportion in the mineral districts than was generally imagined.

Prof. TENNANT observed, that on looking over some of the old rubbish heaps in Shropshire, which had been cast away as refuse matter, he found a large portion of carbonate of lead, which had been regarded as calcareous spar. There were instances in which the carbonate of lead was apt to be overlooked even by those who had a practical knowledge of mineralogy, and a valuable product was thrown away, simply owing to a want of acquaintance with its properties. He fully agreed with the remark that a better practical education was required amongst the people engaged in mining operations. The late Mr. Hugh Lee Pattinson was one who took that matter in hand, and he was happy to find that the example had been followed in other instances. He would particularly allude to the extensive mines under the superintendence of Mr. Sopwith, were thousands of men were employed. He believed the flue at the works at Alston Moor was nearly five miles in length, instead of three miles, as mentioned by Mr. Warrington. He (Prof. Tennant) felt obliged to Mr. Phillips for the way in which he had described the operation of lead smelting, which was of the utmost importance when they considered its extent. With regard to the statistics of this subject, he believed the Chairman would corroborate the statement that there was often difficulty in obtaining precise information.

The CHAIRMAN said that Mr. Tennant was in error. He could with great satisfaction say that in his statistical enquiries, with but one exception, he had never been refused the information he asked for.

Prof. TENNANT was very happy to hear it. He found the value of the metallic minerals in this country was about 16,000,000*l.* per annum; they were, therefore, a most important part of our national wealth, and any information bearing on the subject was necessarily of great interest. In conclusion, Prof. Tennant pointed out the great importance of a more general study of mineralogy, and strongly recommended a visit to the works at Alston Moor, which he said would be highly entertaining as well as instructive.

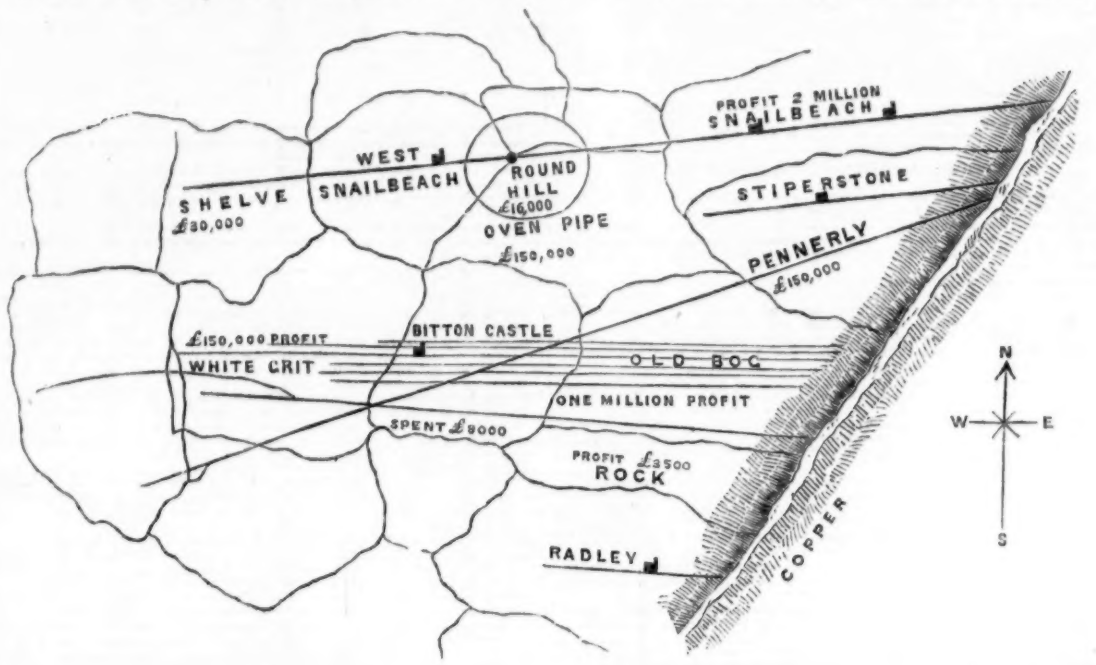
The CHAIRMAN would ask the gentleman who had just addressed them whether he could give them any information as to the combination of sulphide of silver with sulphide of lead?

Prof. TENNANT replied, that it was one of those difficult questions which had not yet been fully resolved, like that of the pure silver that was found in the copper of Lake Superior. Whether the combination was chemical or mechanical he could not say; but his own impression was that the metals were mechanically and not chemically combined.

Mr. J. A. PHILLIPS said that some years since he visited the mines of Lake Superior, and had paid some attention to the combination of the silver and copper. He had found some cases in which the two metals seemed to form an alloy, while in others he had found nicely formed crystals of native copper combined with equally well formed crystals of silver, and on testing these crystals he found both nearly equally pure.

PRELIMINARY PROSPECTUS.

THE BOG LEAD MINING COMPANY [LIMITED], SHROPSHIRE.



In 500 shares of £5 each, fully paid up.
BANKERS—Sir W. Lubbock, Bart., and Co., London.
AGENT—Capt. M. Redge.
SECRETARY—Mr. Thomas Fuller.
OFFICES,—51, THREADNEEDLE STREET, LONDON.

This company is formed in 500 shares of £5 each, fully paid up. No call or liability can attach itself to the holders thereof, with power to raise additional capital, if required, by preference shares or otherwise; also, to accept terms offered by an influential company, if approved of by three-fifths of the present shareholders at a special meeting called for that purpose, to be convened within six months from May 2, whereby the proposition, if carried into effect, will give the present holders £5 per share in cash, and £10 in shares fully paid up, making £7500 for the present £2500 subscribed; also, that the sum of £22,500 shall be provided as working capital.

The present operations are progressing in a very satisfactory manner, and lead ore being raised daily, which will ensure profitable returns. A valuable discovery of lead has been made in new ground in the 25 fm. level, worth £20 per fm.

Application for prospectuses and the remaining shares to be made on or before the 17th May, to Messrs. FULLER and Co., 51, Threadneedle-street, London, where every information may be obtained.

Mr. HYDE CLARKE enquired whether it was not the case in the long flues, of which mention had been made, that the deposit of metal was always found in the largest proportion nearest to the furnace, and less towards the further portions of the flue. There was a gentleman present (Mr. John Phillips) who was able to give them some information as to the mining operations in Spain.

Mr. J. A. PHILLIPS said with regard to the deposits in the flues of furnaces, he was not practically acquainted with the working of all the metals, but with reference to those with which he was specially acquainted, he could say that the largest deposits were in the immediate vicinity of the furnace; and in proportion to the distance from the furnace the amount of the deposit decreased. He also observed that in certain ores—particularly those of silver—the metal was carried off by mechanical action. An old pupil of his, engaged in works in Spain, informed him that he invariably found that the deposit of silver was richer near the surface than elsewhere.

Mr. HYDE CLARKE presumed that the stuff at the further end of the flue was not worth taking out.

Mr. J. A. PHILLIPS remarked that the works in Spain, and elsewhere where silver ores were treated, the deposit, even at the further end of the flues, contained a sufficient amount of silver to render its collection a matter of importance.

Mr. JOHN PHILLIPS was largely interested in the smelting of lead and silver. The important question now was as to the loss of silver sustained in the operation of calcining the ores. In the works in Spain with which he had been connected, the poorer ores, which only yielded about 4 ozs. of silver per 100 lbs. of ore, were calcined in what what was known as Brunton's Calciner, which answered well for ores of that description, but with ores of the richer class the process of calcining by manual labour was found to answer best, because the charge was more carefully stirred up, and there was consequently less loss through the ore being carried off by the draught. He was not competent to enter into the chemical part of the subject, and he had no doubt that with careful manipulation the loss might be much diminished. Reverting to the subject of lead smelting, he was glad to hear Mr. Phillips state the result of his observations as to the saving of lead in the flues in the shape of fumes, because it was a matter of great importance. There were some works in Spain where the loss of lead in the fumes was very great. He particularly alluded to the Linares Works, where the Castilian furnaces were employed, and the loss was considerable until they adopted the plan of the long flue. When this was done the saving during the first month paid a large portion of the expense of building the flue. Then, again, a saving in the length of the flue might be made by the use of condensers; and some improvements have been made in the forms of these condensers. One form had been mentioned as having been recently introduced, in which there was a series of falls of water so arranged as to cool the gases without interfering with the draft of the furnace. In the use of these condensers it was most important to take care that the draft was not interfered with. If the draft was kept perfect they were of great value, and saved the cost of erecting long flues.

The CHAIRMAN said there were one or two points to which it was important that their attention should be called before this discussion closed. In the first place, branching from the subject, though associated with it, there was one important fact connected with lead. In Durham and Northumberland—taking the year 1857—they had 17,000 tons of lead produced, which gave 74,000 oz. of silver, whilst in Cumberland they found that, with a produce of only 4700 tons they had 43,500 oz. of silver. Going on to Yorkshire, they found that 7875 tons of lead were produced, and yet they only obtained from that lead 445 oz. of silver. The remarkable point was, that going southward they found, as they got into Flintshire, with a produce of 2280 tons of lead they had 13,300 oz. of silver. With 5509 tons of lead produced in Cardiganshire they had 35,000 oz. of silver. Going further southward into Cornwall, with 6000 tons of lead produced in 1857, they had 224,277 oz. of silver; and in Devonshire, with 1535 tons of lead produced, they had 50,200 oz. of silver. There was no question but that there was some law regulating this, and it was a subject which called for enquiry. Again, they had the important lead district of Derbyshire, producing 6000 tons of lead, from which it was stated, he believed with some degree of truth, that no silver whatever was obtained. He said, with some *degree* of truth, because the white-lead manufacturers, obtaining the material from the Derbyshire smelters, had, by the use of Pattinson's process, obtained silver from that lead, although it was not obtained by the Derbyshire smelters themselves. Mr. Phillips had mentioned the extraordinary case of "gossans" in connection with a mine in Cornwall containing a large quantity of silver. This had been further exemplified in Camborne, in Cornwall, where the fissures, in some cases at right angles to the main lode, and in others parallel to it, were found to contain an enormous amount of silver existing as a chloride of silver mixed with the oxide of iron. Whilst waiting at the Camborne station one day he saw two tons of that material sent away which was said to be worth 3000*l.* from the silver it contained. Mr. Phillips had also mentioned the importance of looking for nickel and cobalt. There was every reason to believe that Cornwall contained large quantities of cobalt, which was now thrown away. This metal having been found in large quantities in the sandstone formation of Alderley Edge, some 50 years ago, a gentlemen of Liverpool established works at that place for the preparation of smalt, but the Excise came down upon him for the glass duty, and he was surcharged to an extent that ruined him; works, however, were being again established in that place. Cobalt also existed to a great extent in Cumberland, although our principal supply was obtained from the German, Norwegian, and Swedish mines. The Chairman further mentioned a curious fact connected with the mines of the Duke of Devonshire. At Grassington the lead was found only in the bands of limestone, and none whatever existed in the shale, whilst at the distance of ten miles off, at Cononley, the lead was found entirely in the shale and none in the limestone. The cause of this he was not in a position to explain; but it was important that a better series of observations should be made and recorded. He fully agreed with what had been said by Prof. Tennant as to the want of better education of a practical nature amongst the mining community, and those connected with mineralogical pursuits. He was sure they were losing a large amount of valuable products from the want of proper knowledge upon the subject. As an example, he might mention that they were producing large quantities of sulphur from the iron pyrites of Wicklow, which was conveyed to St. Helen's to be manufactured into sulphuric acid, and the material remaining from that manufacture, which was formerly thrown away, was now disposed of to another house, and being roasted with common salt, copper was produced as a muriate and precipitated by iron, and a chloride of silver was likewise produced, which, being dissolved out by a strong brine, was afterwards precipitated by zinc. The silver cake was sent to the metropolis, and instead of fetching the usual price of 5*s.* per oz. it brought from 8*s.* to 10*s.* per oz. on account of the gold it contained. This showed what could be done with a proper knowledge of the subject. He had now to propose a vote of thanks to Mr. Phillips for the valuable paper he had brought before them.—*Journal of the Society of Arts.*

A REVOLUTION IN IRON SMELTING.—It appears that when the Americans are intent upon an object no obstacle, however apparently insurmountable, will hinder them. The ironmasters of the Ohio Valley have formed a notion that their own ores are not sufficiently rich for them, and have, therefore, commenced bringing the rich ores of Lake Superior and Missouri to Pittsburg and the neighbourhood to smelt with Pittsburg coal. At Youngtown, Ohio, they have for some time past been using Missouri iron and the dry coal produced in eastern Ohio raw in the furnace, and the pig-iron manufactured has been declared equal, or superior, to the best charcoal iron made from the native ores of these states. Blast-furnaces are being built at Pittsburg, and the enterprise is said to be more profitable to those engaged in it than working the local ores, which are of poorer quality. The ironmasters anticipate that this mode of proceeding will ultimately keep English and Scotch iron out of the market.

IRON MANUFACTURE.—All interested in the make or use of iron should read Mr. Rogers's new work on *Iron Metallurgy*:—

"I do not hesitate to say Mr. Rogers's work is the most complete combination of sound science and sound practice that has yet appeared on Iron—beyond comparison."—DAVID MUSHET.—Published at the *Mining Journal* office, 26, Fleet-street.

MINING IN JAMAICA.

WHEAL JAMAICA COPPER COMPANY.—Capt. Francis: Charing Cross: The lode in the end of the 65 fm. level north still continues 3¼ ft. wide, with a branch towards the bottom of the end from 9 to 12 in. wide, good saving work; I have not seen this end looking so kindly since we first commenced driving as it does at the present time. The shaft is now down 7 fms. 3 ft. below No. 3 level, making a total from No. 2 of 17 fms., and I hope we shall hole the same to the back of the 50 fm. level by the end of the week. The road-making is being pushed on with all possible speed. Captain Cooper, R.N., accompanied by Mr. Barnes, the manager of the Colonial Bank, and another gentleman, paid a visit to Charing Cross last week, when Mr. Gingell, the engineer of the Clarendon Consolidated Company, went over the mine particularly with them. Nothing can be more satisfactory than the report which the whole unite in making of the general appearance of the mine, and the encouraging prospects it affords. The two Government geologists arrived in the last packet, and will shortly commence their survey of the island. One of them (Mr. Sawkins), you will remember, was here about three years ago. It is worthy of remark how exactly the following prediction in his report of Charing Cross Mine has been verified:—"The character of the ores is in many particulars the same as those of Cuba—the carbonates overlying the oxides, and the oxides the sulphurets, the two latter being separated by quartz and iron pyrites. My opinion is there are not more than a few fathoms below the lowest level." We believe it has been determined that the Government geologists (Messrs. Barrett and Sawkins) will commence their survey by inspection of the mines already opened, before proceeding to that of the general features of the country.

ELLERSLIE AND BARDOWIE MINING COMPANY.—Capt. Holman: Salis-Plain: We are driving from the bottom of the shaft to intersect the lode, and in deepening the shaft 1 fm. for a sink we cut a vein of ore, but only important as showing that the lode holds down to at least our present depth, which is 10 fms. below the bed of the river. There is very little water in the shaft; the new or Holman's cross-cut has drained it dry, or nearly so. Parry's cross-cut is going along famously, and indeed the whole economy of the mine is most favourable. Messrs. Sawkins and Barrett have inspected the ore in store at Kingston, and expressed themselves satisfied with its quality.

RIO GRANDE MINING COMPANY.—Pending the investigation of our properties by Messrs. Barrett and Sawkins, the recently arrived Government geologists, we have limited our active operations in Portland; but we are glad to have to state there is a better prospect of our soon adopting more energetic measures to push on the work of the mines, by the application of increased means for that purpose, respecting which you will be more fully instructed hereafter.

CLARENDON CONSOLIDATED.—J. Martin, April 5: Stamford Hill: We have just cut the north wall of the south lode in the 58, to the west of the shaft, and find, for the little we seen, it contains copper ore and mundic, with prian, but we have not seen enough of it as yet to tell its value or its size. In the 58, east of shaft, we have cut through the cross-course. I am obliged to suspend the 58, south and east, in order to get the pumps and rods in the shaft below the 46, as we have to remove the man-engine out of the way. We have met with a small branch in the cross-cut south in the 46, composed of green carbonate and prian, with a little copper ore. I think we have about 6 fms. more to drive to cut the main lode, to the east of the cross-course. The 46, west of shaft, is without any alteration to notice. I have stopped the end for the present, and have put the men to assist with the engine. We shall have the pumps and engine-rods in the shaft by the 9th. All other parts of the work are being pushed on with vigour. I hope when I next write you we shall have the engine at work.

PEAT FUEL.—In your paper of last week (see *Mining Journal*, April 9) I was pleased to see a notice of an "Irish Vegetable Fuel Smelting Company," for working the ores of that country. This is an indication of the decay of that narrow jealousy, or neglect, which has so long rendered valueless the mineral wealth of Ireland. Vast as it is, its development need not be feared by the capitalists or manufacturers of this country, for a market will be provided for it by the universally growing demand for engineering material, which is as yet in its infancy. As you have stated, the iron of Ireland once stood first in the markets of the earth; a thousand years ago it formed a large item of the trade with Spain. I have seen an old Irish sword that could be bent to a hoop 9 in. in diameter, and would instantly resume its straightness. This iron was made with the charcoal of the woods of oak, and the peat now suited for smelting purposes is chiefly composed of that tree, having undergone a process of decomposition equal to carbonisation. The preserving qualities of bog peat is due to the quantity of oak wood which it contains. Having long foreseen the virtue of peat as a fuel for smelting, if at all properly managed, I feel confident of the success of the undertaking. In many instances these masses of fuel are surrounded by rich ores cropping out on the surface. There are three classes of peat—fum, slean, and bog. Only the two last are suitable for smelting purposes, the first being too light and spongy. Slean is a rather dense brownish peat, composed of horizontal layers; the forms of its components are slightly traceable in it. It increases in density from the surface downwards, and is generally about 10 ft. deep. In its normal state (when dry) it is about one-fourth lighter than coal, and burns with a whitish ash. This class is the most generally diffused. Bog is darker and heavier than slean, and no trace of its components is visible, except oak and hazel nuts, and logs of oak trees. It is sometimes 30 ft. deep, and is generally situated in the gorges of hills. Turf made from it, after the fashion of the country, is about the same weight as coal, and burns with a strong heat. This is the most suitable peat for smelting. If cut with an angular spade in pieces of about 6 in. square and 1 ft. deep, and compressed to about 6 in. or 4 in. deep, according to the degree of moisture, it will make an excellent smelting fuel, and might be delivered in the Midland Counties at one-half the cost of coke. It is my opinion that the use of this fuel will produce an article equal to the charcoal iron of Northern Europe.—E. A. LEONARD, Birmingham, April 25.—*Engineer.*

PUDDLED STEEL was made above twenty years ago by the celebrated steel-maker, Solley, from Indian charcoal pig and hematite pig-iron, by using in the slag both manganese, common salt, and clay—which invention was patented by Dr. Schafhautl, of Munich, and sold to Solley. The ores from which these irons were made, containing but little manganese and clay, required those ingredients to be added in the puddling furnace, and even then the charge remained four or five hours, and even longer, in the slag-bath before the necessary change was effected to produce steel. About ten or more years ago it was found in Westphalia that Prussian pig-iron could be converted into steel without the use of manganese, clay, &c.; and since that time the manufacture of puddled steel has gradually increased in Prussia and other German States, in Belgium and France, and last year was successfully brought out at the Mersey Iron-works, Liverpool; before which, without the public being generally aware, it had been made at Low Moor in large quantities for the Sheffield market. Among the many Prussian works at which steel is thus made, the Phœnix Company (who have about a million pounds sterling invested in their different establishments) make largely, and the men are ordered to puddle steel or iron just as it is required. At the works founded by our countryman, John Cockerell, at Seraing, six puddling furnaces are used to make steel; and since they have commenced this branch of business no other steel is used in the manufacture of fitters' tools, or any other purpose. The puddled steel is, however, for the finer purposes, melted into cast-steel. Puddled steel is also made in France, and in Nassau at large works I erected there in 1842, where, by the last accounts I received, only steel for railway wheel tyres was puddled there; so that from the foregoing it may be seen that puddling pig-iron into steel is an old-established operation.—J. PLAYER, Middlesbro'-on-Tees, April 25.—*Engineer.*

RAILWAY BREAKS.—The apparatus invented by Mr. Walter Hall consists of a square bar suspended under each carriage, the connection being made by a universal-joint coupling, thus rendering the break continuous throughout the train, so that three or four breaks may be applied simultaneously. In making up a train the break-blocks of the break-vans are screwed up close to the rims of the wheels, and then the coupling is effected, so as avoid the possibility of a slack. The operation of the apparatus is said to be very satisfactory, and the cost of applying it is a mere trifle.

THE SMELTING, REDUCTION, LIME, AND COAL COMPANY (LIMITED).

Capital £80,000, in shares of £1 each. Deposit, 10s. per share.

DIRECTORS.

WILLIAM PEACE, Esq., F.G.S., Wigan, Chairman.
ISAIAH BOOTH, Esq., Manchester, Managing Director.
JOHN HEELIS, Esq., Manchester.
THOMAS GOODIER, Esq., Liverpool.
FRANCIS LANGTON, Esq., Brighton.
JOHN THOMPSON, Esq., M.A., Wigan.
JOHN SHIMMIN, Esq., Liverpool.
JOSEPH WILSON, Esq., Liverpool.

BANKERS—Messrs. T. Barned and Co., Lord-street, Liverpool.
AUDITOR—James Wensley, Esq., Gloucester-place, Liverpool.
SOLICITOR—Maskell W. Peace, Esq., Wigan.
SECRETARY—Mr. F. Owen.

OFFICES,—6, CASTLE STREET, LIVERPOOL.

The objects of the company are to carry on the working of coal, cannel, and ironstone, smelting, and lime burning, and other operations in aid of the same.

The company have purchased a freehold estate at Mold, in Flintshire, 114 acres in extent, and also the leases of the coal, cannel, and ironstone, existing under adjacent estates, comprising an additional area of about 300 acres, held upon favourable royalties for 21 and 25 years, from 1857.

These properties are advantageously situated at a distance of 29 miles from the large export markets of Birkenhead and Liverpool, on the Mold branch railway, with which the company's works and collieries will be connected by a short line of a mile in length, of easy construction, over land already leased and purchased for the purpose.

Mr. Peace estimates that the estates of the company will yield from mines now won and in work nearly 4,000,000 tons of coal, exclusive of additional seams of coal and ironstone which are referred to by Mr. Higson in a report made by him.

The quality is eminently adapted for smelting, steam, and other purposes, and is also particularly suitable for exportation, being similar in character with the Hartley coals of the North, and the demand for this description of coal is great and increasing.

The present shafts are being enlarged, new machinery is being put up, and preparations are being made for carrying on the colliery works on an extensive scale. Valuable lime is found in the immediate neighbourhood, leases of which are attainable by the company on advantageous terms.

In addition to the coal and lime, there exists in the freehold estate large deposits of ironstone, which can be profitably disposed of to the ironmasters of the neighbourhood.

The profits from smelting are generally very large, and the company anticipate considerable profits therefrom. The locality is suitable, as it abounds in lead and zinc ores, and possesses unusual facilities for conveyance by railway and for water carriage by the Dee and the Mersey.

In addition to the ores of the district, the promoters have made advantageous arrangements for the reception of consignments of foreign ores, samples of which have been tested in this country, and proved to be of rich quality.

The directors have fixed the present amount of capital at £80,000. From the reports of several experienced mining engineers, the directors are warranted in anticipating a profit on the capital embarked, at the rate of 30 per cent. per annum. The vendors of the collieries have accepted the purchase money in paid-up shares of the company, leaving only a limited number to be allotted, and for which the directors are prepared to receive applications up to the 14th May next.

The company being under the Limited Liability Act, shareholders having paid up their shares in full are exonerated from all further liability.

In the case of shares being paid up in full, the company will allow interest at the rate of £5 per cent. per annum upon the balance paid up beyond the sum for the time being called for.

Application for the remaining shares must be made in the following form, and forwarded to the secretary, Mr. F. Owen, 6, Castle-street, Liverpool:—

To the Acting Directors of the Smelting, Reduction, Lime, and Coal Company (Limited).

GENTLEMEN,—I request you will allot me shares in the undertaking of the above company, and I hereby agree to accept the above number of shares, or any less number that may be allotted to me, and to pay a deposit of 10s. per share, at such time and place as may be appointed for that purpose in the letter of allotment, and that this application shall be taken as an acceptance by me of so many shares, not exceeding the number above-mentioned, as you may think fit to allot me.

Name in full.....
Residence .....
Profession, trade, or occupation .....

WHEAL WHIDDON TIN AND COPPER MINE,

ASHBURTON, DEVON.

Conducted on the "COST-BOOK PRINCIPLE."

In 2000 shares of £3 each. 10s. per share to be paid on allotment, and the remainder at periods of three months, by calls not exceeding 10s. per share.

The attention of *bona fide* mining investors is respectfully called to the plan adopted in the proposed working of this mine, which quite divests it of all speculation, the promoters contracting to put it in a productive state, and allowing their remuneration to be dependent on its becoming so.

Prospectuses, containing proposals of working, and reports of Mr. N. Ennor, Captains Hosking, Hampton, Faull, Rickard, and Skewis, speaking in the highest terms of the prospects, and other information, may be obtained of, and applications for shares made to, Messrs. SANDFORD and MORTIMER, Exeter; Mr. J. K. THOMAS, Clare-street, Bristol; Mr. J. THORNE, Lostwithiel, Cornwall; or of the Purser, at the office of the company, Ashburton.

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THE NEW GRANADA COMPANY (LIMITED).

Capital £20,000, in 20,000 shares of £1 each.

DIRECTORS.

CHARLES JOHNSTON, Esq.
AMBROSE MOORE, Esq.
GEORGE KNIGHT HUXLEY, Esq.
ROWAND RONALD, Esq.
(With power to add to their number).

SOLICITORS—Messrs. Hughes, Kearsey, Masterman, and Hughes.
BANKERS—Messrs. Masterman, Peters, and Co.
SECRETARY—Mr. George Edward Breffit.

OFFICES,—192, GRESHAM HOUSE, OLD BROAD STREET.

This company has been formed for the purchase of the valuable mines and lands of Frontino and Bolivia, and other property now belonging to the New Granada Company, upon certain terms to be specified hereafter.

The mines and lands of Frontino and Bolivia are situated respectively in the provinces of Antioquia and Medellin, New Granada, the former near the city of Antioquia, about 40 miles due east of the Atrato, and the latter close to the city of Remedios, not far from the River Magdalena.

The two properties comprise each about 2000 acres of freehold land, abounding in rich gold lodes, hitherto only partially opened up, and presenting a very extensive field for mining operations.

The Frontino Mines are situated on the summit of the mountain of the same name, at an altitude of 7000 ft. above the level of the sea. The climate, owing to this great elevation, is temperate, and admirably adapted for purposes of labour. The property affords excellent timber in abundance for all the requirements of the establishment, while a considerable stream, which traverses it, supplies the motive power to the several mills stationed along its course, for the purpose of crushing the mineral from the mines. Of the several valuable lodes it contains, only one has hitherto been worked—a pyrites lode of great extent and depth, affording practically an inexhaustible supply of mineral.

Much of the above description applies to the Bolivia property, the main distinction consisting in the nature of the lodes, which at Bolivia are quartz, instead of pyrites.

The works in operation for developing and improving these properties are, so far as Frontino is concerned, upon an extensive scale, consisting of mills, furnaces, houses, workshops, water-courses, mine works, &c., mostly new, and all in excellent order, in addition to which there is a considerable supply of stores for mining purposes.

The average working costs of Frontino during the last two years have amounted to £9500, and the returns to £12,000 per annum. At Bolivia, where the works and operations are upon a much more limited scale, the average costs have been £2650, and the returns £3100 per annum. These costs are irrespective of the office expenses in London and New Granada.

Even with respect to Frontino, however, the above scale of working must not by any means be taken to represent the real capabilities of the mine, for only one lode at present is being worked, and that but partially, while the mill power of the establishment is fully equal to the crushing of more than double the present supply of mineral.

So ample, indeed, are the resources of Frontino, and so capable are they of affording a profitable employment for capital, that the directors have it in contemplation to sell the Bolivia property, if a satisfactory price can be obtained for it, and thus to concentrate the capital and energies of the company entirely upon the Frontino Mines, thereby enabling the superintendent to bestow his full attention upon one property, instead of dividing it with weakened effect between two lying at a remote distance from each other, and by this means saving travelling and other expenses.

In bringing the mines to a productive condition, however, the directors of the New Granada Company found it necessary to expend so large a sum in addition to the ordinary working costs, that the funds of that company are exhausted, and the directors are unable to carry on the undertaking without the assistance of additional capital, and hence has arisen the necessity of a reorganisation of the company upon a modified basis, in order to obtain such additional capital.

Upon the proposed basis the new company will, in consideration of 15,000 of their shares, subject to the annexed conditions, acquire possession of property which has cost upwards of £50,000, and which has proved itself to be capable, if adequate means be provided, of yielding ample profit.

CONDITIONS OF PROPOSED SALE AND PURCHASE OF THE PROPERTY OF THE NEW GRANADA COMPANY.

1.—The purchase money to be 15,000 shares of the New Granada Company (Limited), credited as paid-up to the extent of 12s. per share.

2.—The above 15,000 shares, constituting the purchase money, to be given to the holders of certificates for shares in the New Granada Company, registered and non-registered without distinction, in the proportion of one share in the new company for four shares in the old company, upon their delivering up their certificates in the old company, and paying up the balance of 8s. per share on each new share, or 2s. per share upon the old shares.

3.—The holders of certificates of shares in the old company to be allowed until the 21st of June, 1859, to bring in their certificates in exchange for the new shares.

4.—The remaining shares of the capital of the new company, after payment of the purchase money, to be allotted to the public generally, upon payment of £1 per share.

DEVON KAPUNDA COPPER AND SILVER-LEAD MINING COMPANY (LIMITED).

PARISH OF SOUTH SYDENHAM, COUNTY DEVON.

Capital £30,000, in 30,000 shares of £1 each.

A deposit of 5s. per share to be paid on application for shares, and 5s. per share within one month after allotment of shares.

With two calls, if required, of 5s. each share, at intervals of not less than three months, and with sixty days' notice in each case.

DIRECTORS.

J. H. HITCHINS, Esq., Tavistock, Consulting Mining Engineer to the Devon Great Consols.
JOHN WILLIAMS, Esq., Highgate (Messrs. Nicholls, Williams, and Co., Bedford Ironworks, Tavistock).
FREDERICK HAMILTON, Esq., Gresham House, Old Broad-street.
CHARLES PAUL BERKELEY, Esq., Lansdown-place, Russell-square.

SOLICITORS—Messrs. Simpson and Co., 7, Golden-square, W.C.
BANKERS—City Bank, Threadneedle-street, London, E.C.
BROKERS—Messrs. Castello Brothers, 4, Cushion-court, Old Broad-street, E.C., and 30, Regent-street, Waterloo-place, S.W.
SECRETARY (pro tem.)—Frederick Bell, Esq.

OFFICES,—WALBROOK HOUSE, No. 37, WALBROOK, LONDON, E.C.

Prospectuses, with maps, sections, &c., and forms of applications for shares, may be obtained at the offices of the company, or on application to the solicitors or brokers.

London, April 28, 1859.

THE SOUTH DEVON IRON AND GENERAL MINING COMPANY (LIMITED).

Capital £100,000, in 100,000 shares of £1 each
(Of which 40,000 have already been subscribed for).

DIRECTORS.

WILLIAM SARL, Esq. (firm of Sarl and Sons, Cornhill.)
GEORGE ORD, Esq., Brixton Hill, Surrey.
LYNCH WHITE, Esq., iron merchant, Upper Ground-street, London; and Clapham-park, Surrey.
WILLIAM SWINSCOW, Esq., Brixton Hill, Surrey.
SAMUEL BOUSFIELD, Esq., Oritons, Sussex; and Streatham Hill, Surrey.
WILLIAM HUGGINS, Esq., F.R.A.S., Upper Tulse Hill, Surrey.
(With power to add to their number.)

BANKERS—The City Bank, Threadneedle-street, London; the Branches of the Devon and Cornwall Bank.
BROKERS—Messrs. Carden and Whitehead, Royal Exchange-buildings, London.
CONSULTING ENGINEER—Josiah Hugo Hitchins, Esq., Devon Great Consols, Tavistock
SOLICITORS—Messrs. Prichard and Collette, 57, Lincoln's Inn-fields.
SECRETARY—Mr. George F. Goodman.

OFFICES,—CITY BANK CHAMBERS, THREADNEEDLE ST., E.C., LONDON.

This company has been formed for the purpose of acquiring and working some of the richest and most promising iron and tin mines—the Smallacombe freehold estate, upon which the Atlas tin and iron lodes are now being worked; the Hercules Iron Mine, on the Higher Bowden estate, both in Devon; and the Phœnix Iron Mine, in the parish of St. Issey, Cornwall, as shown in the accompanying plans and reports. The working of these properties alone will constitute this company the greatest vendors of iron ores in the Western Counties.

It is acknowledged that no better opening presents itself for the profitable employment of capital than the mining of iron ore. This ore occurs in greater abundance and regularity than those of other metals, and the demand is constant and increasing, and the sale highly remunerative.

Detailed prospectuses, with reports, &c., can be obtained of the secretary, or of the brokers, and to whom applications for shares should be forwarded.

HIRNANT LEAD MINES (LIMITED),

NEAR LLANGUNOG, MONTGOMERYSHIRE.

Capital £3000, in 3000 shares of £1 each. Deposit, 5s. per share.

The remaining 15s. per share to be called for as may be required, in calls not exceeding 2s. 6d. per share, and not oftener than every two months.

The company is intended to be incorporated under the provisions of the Limited Liability Act, 19 and 20 Vic. cap. 47.

BANKERS—London and Westminster Bank, Lothbury, London; the North and South Wales Banking Company, Wrexham.
SECRETARY—Mr. Thomas Henshaw, Hope-street, Wrexham.

The Hirnant Mines have hitherto been only worked by a few individuals, principally by Mr. EDWARD LLOYD, of Pen-y-bont Vawr, and the workings show the existence of both lead and copper ore; the former, there is every reason to believe, will be found in a very considerable body.

The present holders of the mines would on no account part with their interest if they possessed the means to carry them on in a proper manner, and they propose to dispose of their interest in them for £1000, £800 of which will be taken in shares, and the remaining £200 to be paid to Mr. Lloyd, for work done by him at the mines; £50 has also to be paid to Mr. PILKINGTON, for his survey and report, with plans and sections, which are carefully got up to show the true value of the mines, but this sum he has agreed to take in shares.

It is computed that the expense of sinking to a depth of 50 yards, and erecting the necessary machinery will amount to £500. Purchasing the interest of the present holders, cost of lease, plans, sections, and surveying, &c., is estimated at £1300; so that, after sinking a depth of 50 yards, a sum of £1200 will be available for exploring and carrying on the mine, when it is fully considered lead will bear largely. The liability of the shareholders will be strictly limited to £1 per share.

Plans and sections of the mines, with samples of the ore, may be seen on application to JAMES CROFTS, Esq., mining broker, 1, Finch-lane, Cornhill, London; WILLIAM JONES, Esq., 3, Serjeant's Inn, Fleet-street, London; J. PILKINGTON, Esq., mining engineer, Wrexham; or to the SECRETARY, Wrexham; to any of whom applications for shares (in the annexed form) may be addressed.

To the Committee of the Hirnant Lead Mining Company (Limited).

GENTLEMEN,—I request you to allot me shares in the above mining company, and I agree to accept the same, or any lesser number that may be allotted to me. I enclose herein £ , being the first payment of 5s. per share thereon, for which I request you will forward me the bankers' receipt.

Name in full.....
Residence .....
Occupation.....

Dated this day of , 1859.

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LONDON: Printed by RICHARD MIDDLETON, and published by HENRY ENGLISH (the proprietors), at their office, No. 26, FLEET-STREET, where all communications are requested to be addressed. [May 7, 1859.